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(54) Display control apparatus and display system

(57) A display system for receiving image data from a plurality of image sources and displaying the received image data on a display unit. The display system includes: an input unit for inputting a control signal supplied from an input/output unit, a controller for controlling an image to be displayed on the display unit in accordance with the control signal input from the input unit; an image selection unit for selecting a desired image from images displayed on the display unit; and a switching unit for switching an image to be controlled by the controller in accordance with the image selected by the image selection unit.

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[0011] Fig. 2 is a diagram showing examples of a display layout of a display device when a plurality of image sources are input.

[0012] Fig. 3 is a diagram showing the structure of a selection portion.

[0013] Figs. 4A, 4B and 4C are diagrams showing examples of images and a display pointer on a display device.

[0014] Fig. 5 is a block diagram showing the structure of a display system according to a second embodiment of the invention.

[0015] Fig. 6 is a block diagram showing the structure of a display system according to a third embodiment of the invention.

[0016] Figs. 7A and 7B show a display screen, a window, a main pointer, and an image source pointer on a display control system, Fig. 7A illustrates a control by the image source pointer, and Fig. 7B illustrates a control by the main pointer.

[0017] Figs. 8A and 8B show a display screen, windows, a main pointer, and an image source pointer on a display control system, Fig. 8A illustrates a selection of a window of an image source 1-1 with the main pointer, and Fig. 8B illustrates a selection of a window of an image source 1-2 with the main pointer.

[0018] Fig. 9 is a diagram illustrating a relation between a general software configuration and an embodiment software configuration under the graphic user interface (GUI) environment on the image source side.

[0019] Fig. 10 is a diagram showing an operation screen of an application running under the GUI environment on the image source side according to an embodiment.

[0020] Figs. 11A and 11B show the display screen of a display control system, Fig. 11A illustrates a selection of a window of an image source 1-1 with a main pointer, and Fig. 11B illustrates a selection of a clip board icon Y1 with a main pointer.

[0021] Figs. 12A and 12B show the display screen of a display control system, Fig. 12A illustrates a selection of a window of an image source 1-1 with a main pointer, and Fig. 12B illustrates a selection of a window of an image source 1-2 with the main pointer.

[0022] Fig. 13 is a flow chart illustrating the operation of a main process to be executed when data is input from an infrared data control portion of a control portion 6 of a display control system 40.

[0023] Fig. 14 is a flow chart illustrating a process R1 in the flow chart shown in Fig. 13.

[0024] Fig. 15 is a flow chart illustrating a process R2 in the flow chart shown in Fig. 13.

[0025] Fig. 16 is a flow chart illustrating a process R3 in the flow chart shown in Fig. 13.

[0026] Fig. 17 is a flow chart illustrating a process R4 in the flow chart shown in Fig. 13.

[0027] Fig. 18 is a flow chart illustrating a process R5 in the flow chart shown in Fig. 13.

[0028] Fig. 19 is a flow chart illustrating the operation of a main process to be executed when data is input from a packet control portion of the control portion 6 of the display control system 40.

[0029] Fig. 20 is a flow chart illustrating a process P1 in the flow chart shown in Fig. 19.

[0030] Fig. 21 is a flow chart illustrating a process P2 in the flow chart shown in Fig. 19.

[0031] Fig. 22 is a flow chart illustrating a process P3 in the flow chart shown in Fig. 19.

[0032] Fig. 23 is a flow chart illustrating a process P4 in the flow chart shown in Fig. 19.

[0033] Fig. 24 is a flow chart illustrating a process P5 in the flow chart shown in Fig. 19.

[0034] Fig. 25 is a flow chart illustrating a process P6 in the flow chart shown in Fig. 19.

[0035] Fig. 26 is a flow chart illustrating a process P7 in the flow chart shown in Fig. 19.

[0036] Fig. 27 is a flow chart illustrating the operation of a process to be executed when a message is input from GUI of the control portion 6 of the display control system 40.

[0037] Fig. 28 is a flow chart illustrating a process A1 in the flow chart shown in Fig. 27.

[0038] Fig. 29 is a flow chart illustrating a process A2 in the flow chart shown in Fig. 27.

[0039] Fig. 30 is a flow chart illustrating a process A3 in the flow chart shown in Fig. 27.

[0040] Fig. 31 is a flow chart illustrating a process A4 in the flow chart shown in Fig. 27.

[0041] Fig. 32 is a flow chart illustrating the operation of a process to be executed when a display software loading command is obtained from a serial communications driver of the control portion 6 of the display control system 40.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

(First Embodiment)

[0042] Fig. 1 is a block diagram showing the structure of a display system according to the first embodiment of the invention.

[Description of Each Component]

[0043] Each block shown in Fig. 1 will be described. In this embodiment, information supplied from four independent image sources (such as note PC) is displayed on one monitor and an input/output device of each image source, such as a mouse, a keyboard, a remote controller and a speaker, is controlled in cooperation with image data displayed on the monitor. The number of image sources may be larger than or smaller than four.

[0044] Reference numeral 31 represents a display system. Reference numerals 1-1, 1-2, 1-3 and 1-4 represent sources of image signals (hereinafter called "im-

plied from each image source 1. Reference numeral 27 represents a D/A converter for converting input digital sound data into analog data. Reference numeral 28 represents a sound amplifier, and reference numeral 29 represents a speaker of the display system 31.

[0050] The operation of the display system of the embodiment will be described with reference to Fig. 1.

[Initialization]

[0051] Each image source 1 and display system 31 communicate with each other via a bi-directional serial communications line of the input portion 2 after powers are turned on. Each input portion 2 supplies the image source 1 with data such as the numbers of dots, display lines, display colors, and a video output timing. The communications are performed by using a communications protocol predetermined both by the input portion 2 and image source 1. For example, a DDC (Display Data Channel 1) of VESA (Video Electronics Standards Association) in USA may be used, and EDID (Extended Display Identification Data) of VESA may be used as the data format. In the communications, the numbers of display dots, display lines and display colors of the display device 13 are supplied, or the display format predetermined at the control portion 6 may be supplied. In accordance with the received information, each image source 1 outputs image data and its control signals to the input portion 2.

[0052] The input portion 2 always monitors a connection identification signal to be supplied from the image source in order to check the number of image sources 1 connected to the display system 31. The input portion 2 receives the connection identification signal from the image source as a logical binary signal "1" or "0".

[0053] If the connection cable is cut or the power of the image source is turned off, the logical signal "0" is supplied because the input portion 2 is terminated with a resistor. The display system 31 can therefore recognize that image data is not input. This monitor information is supplied to the control portion 6 at a predetermined interval.

[0054] The control portion 6 first detects the connection identification signal of the input portion 2-1. If the connection identification signal is "1", the input portion 2-1 sends the received image data to the display format conversion portion 3-1 to covert the format of the image data, whereas if the connection identification signal is "0", the control portion 6 checks the connection identification signal of the next input portion 2-2 and scans the input portion 2 until the connection identification signal of "1" is detected. If all the connection identification signals are "0", the display system 31 enters a power save mode to lower a power supply to the constituent elements excepting the control portion 6, selection portion 14, packet distribution control portion 15, packet control portion 16 with FIFO, FIFO memory 17, infrared data conversion portion 18, infrared data control portion 19, and infrared data receiving portion 20.

[0055] Display data in ROM of the control portion 6 is stored in the superposition data memory 10 via the bus and data controller 8.

[0056] Instead of ROM of the control portion, the display data may be supplied to the control portion 6 via the selection portion 14 and packet control portion 16 with FIFO to be described later.

[Connection of One Image Source]

[0057] The case wherein the connection identification signal of only the input portion 2-1 is "1" and the signals of the other input portions are "0", will be described.

[0058] The input portion 2-1 outputs image signals having a desired format to the display format conversion portion 3-1. If the supplied display format is equal to the display format (dot number, line number and color number) of the display device 13, the supplied image data is passed to the bus interface, whereas if they are different, the supplied display format is converted into the display format of the display device 13 by processing the supplied image data to have proper dot number and line number. If the number of colors of the supplied image data is larger than the number of colors the display device 13 can display, the number of bits of image data is reduced at an intermediate image data process such as a dither process.

[0059] The image data output from the display format conversion portion 3-1 is stored in the frame memory 9 via the bus interface 4-1, bus controller 5 and frame memory controller 7.

[0060] The frame memory 9 has a plurality of hierarchical levels. The level at which the input data is stored is controlled by the bus controller 5 under the control of the control portion 6.

[0061] Image data stored in the frame memory 9 is output to the bus at a timing controlled by the control portion 6 and to the output display format conversion portion 11. In this case, the hierarchical level of image data to be output is determined by the bus controller 5 under the control of the control portion 6.

[0062] In addition to the input image data, display data stored in the superposition data memory 10 is output to the bus via the superposition data controller 8 under the control of the control portion 6 to be displayed on the display device 13. Either the superposition data or the input image data output to the bus via the frame memory controller 7 is selected by the output display format conversion portion 11 and the selected data is supplied to the display driving controller 12. This selection timing is determined by the control portion 6.

[0063] The output display format conversion portion 11 converts the selected image data into data having a data bus width and the like suitable for the display driving controller 12. The image data converted by the conversion portion 11 is output to the display driving controller 12 which generates a drive signal for driving the

priority order of the hierarchical level at which image data is stored.

[0078] The display example (a) shown in Fig. 2 is realized in the following manner. The display format conversion portion 3-1 stores the image data of the input portion 2-2 in the frame memory 9 at the hierarchical level of the second priority order without performing scaling. The display format control portion 3-2 performs scaling of the image data of the image source 1-2 to reduce the image data by thinning input display dots and lines. The reduced image data is stored in the frame memory 9 at the hierarchical level of the first priority order.

[0079] In the display example (b), both the display format conversion portions 3-1 and 3-2 perform scaling to display two images without superposing them.

[0080] In the display examples (c) and (d), the images (1-1) and (1-2) of the display examples (a) and (b) are exchanged. In the display example (e), both the display format conversion portions 3-1 and 3-2 do not perform scaling and the image data is stored in the frame memory 9 at the hierarchical level of the first priority order after each image data of the images (1-1) and (1-2) is processed at least in the unit of one pixel by a calculation circuit of the frame memory controller 7.

[0081] As described above, when two or more images are input, the display layout of the images can be freely changed by using scaling at the display format conversion portions 3 and the hierarchical level of the frame memory 9.

[0082] This display layout change can be performed by instructing the control portion 6 to present one of the display examples (a) to (e) shown in Fig. 2 by pressing the button 30 of the display pointer controller 21 and notifying the control portion 6 of the depression via the receiving portion 20 and infrared data control portion 19. Each time a display layout change is instructed, the control portion 6 notifies a change in the display parameters to the display format conversion portion 3, bus controller 5 and frame memory controller 7.

[Switching between Input/Output Devices by Using Display Pointer]

[0083] Next, a method of switching between input/output devices of image sources by using a display pointer will be described which method is a characteristic feature of the invention.

[0084] As described earlier, the display pointer controller 21 has the joy stick (mouse) 22 as an input device of image sources, the control button 23 functioning as the confirmation button of the joy stick 22, the joy stick 24 for controlling a pointer displayed on the display device -13 and superposed upon the input image data, and the control button 25 functioning as the confirmation button of the joy stick 24. In this embodiment, the joy stick is used as the input device of the image source 1, an input device such as a keyboard and a tablet may also be used and the output device such as a liquid crystal display and a small printer may also be used.

[0085] After an initialization process of determining a reference point of the X and Y coordinates is performed while viewing a superposition pointer displayed on the display device 13, the X and Y coordinate values of the joy stick 22 are supplied to the control portion 6 via the receiving portion 20 and infrared data control portion 19. The control portion 6 calculates coordinate values of four corner points of a window of the display device in which an input image is currently displayed, by using the numbers of dots and lines used by each display format conversion portion 3, and always stores the calculated coordinate values.

[0086] The X and Y coordinate values sent from the joy stick 24 are sent to the control portion at a predetermined interval. In order to display the pointer figure stored in the superposition data memory 10 at the position indicated by the coordinate values, the superposition data is output to the output display format conversion portion 11. At this time, the joy stick 22 which is one of the image source input/output devices is connected to the image source 1-1 via the receiving portion 20, infrared data control portion 19, infrared data conversion portion 18, FIFO memory 17, packet distribution control portion 15 and selection portion 14.

[0087] The pointer figure in the superposition data memory 10 may be changed by each image source via the route of the selection portion 14, packet control portion 16 with FIFO, control portion 6, bus controller 5 and superposition data controller 8, or may be replaced by a pointer figure stored in ROM of the control portion 6 via the route of the bus controller 5 and superposition data controller 8.

[0088] If a user wants to use the joy stick 22 as the input/output device of the image source 1-2 instead of the image source 1-1, the user moves the superposition data figure to the area where the image (1-2) is displayed by using the joy stick 24 and depresses the coordinate confirmation control button 25. Information indicating a depression of the control button 25 is transferred to the control portion 6 via the receiving portion 20 and infrared data control portion 19. Through calculation of the X and Y coordinate information when the button depression information is received and the already known coordinate values of four corner points of the image data display window of each image source, the control portion 6 judges the display window in which the X and Y coordinate values of the display pointer joy stick 24 are located to thereby select the desired image source.

[0089] The control portion 6 supplies a control signal to disconnect once the selection portion 14, and after a predetermined time lapse, the serial data line of the image source 1-2 is connected to the packet distribution control portion 15.

[0090] With the above operations, peripheral devices using a serial data protocol capable of a hot plug-in con-

input, the display of the image data can be changed freely in accordance with the scaling by the display format conversion portion 3 and the hierarchical level of the frame memory 9. Therefore, the display control of images entered from a plurality of image sources, such as a change in the display layout, can be performed easily by using the display controller 21 which is the input/output device common to all the image sources.

(Second Embodiment)

[0107] Fig. 5 is a block diagram showing the structure of a display system according to the second embodiment of the invention.

[0108] In the second embodiment, four television tuners are used as the image sources. The other structures are similar to the first embodiment.

[0109] Television signals received by an antenna 209 are detected and frequency-modulated by television tuners 205 to 208. Each encoder 201 to 204 decodes television signals having a standard signal format such as NTSC, PAL and SECAM into composite video signals and sound signals.

[0110] The decoded composite signal is input to each input portion 2 and displayed on the display device in the manner similar to the first embodiment.

[0111] For the control of each tuner such as a selection of a broadcast station, on/off information of the button of the display pointer controller 21 is supplied to the selection portion via the serial control signal line and via the route of the receiving portion 20, infrared data control portion 19, infrared data conversion portion 18, FIFO memory 17 and packet distribution control portion 15. The control portion 6 controls the selection portion 14 to select one of the tuners 205 to 208 by the joy stick 24 which tuner receives television data of a display image. In this manner, the television program of the display image received by the tuner and selected by the joy stick 24 can be changed easily. In response to a change in the television program, sound data is reproduced from the speaker 29 via the packet distribution control portion 15, packet control portion 26, D/A convertor 27 and sound amplifier 28.

[0112] In the second embodiment, the control of the image entered from the television tuner, such as a change in the television program, can be performed with advantageous effects similar to the first embodiment.

[0113] In the first and second embodiments, control programs may be supplied from an external apparatus, and in accordance with the supplied control programs, the display of an image on the display device 13 may be controlled. In this case, the control is executed by the control portion 6 in place of the display pointer controller 21. In the second embodiment in particular, if a digital television broadcast station superposes control data, such as display image scaling and superposition, upon television image data, various controls such as display control can be performed by using the superposed control data, without controlling the control portion 6 by using the display pointer controller 21. In this case, the control data is supplied to the control portion 6 via the packet control portion 16 with FIFO without using the relays 101 to 104 of the selection portion 14.

[0114] In the first and second embodiments, when data of the display pointer and joy stick is transferred from the display pointer controller 21 to the display system 31, infrared light is used. The invention is not limited only to infrared light, but radio waves or signalling lines may also be used.

(Third Embodiment)

[0115] Fig. 6 is a block diagram showing the structure of a display system according to the third embodiment of the invention. In the third embodiment, information supplied from four independent image sources is displayed on one monitor. The number of image sources may be larger than or smaller than four. In Fig. 6, components having similar structures to those shown in Fig. 1 are represented by using identical reference numerals, and the description thereof is omitted.

[0116] Referring to Fig. 6, image sources 1-1, 1-2, 1-3 and 1-4 have user information input means (not shown) such as a mouse for entering user information indicating, for example, a position of an image source pointer. Reference numerals 14-1, 14-2, 14-3 and 14-4 represent a packet control portion with FIFO which is used for controlling a timing of transmitting and receiving high speed serial communications packet data between the image sources 1-1 to 1-4 and the control portion 6 of the display system 40 of this embodiment. In this embodiment, by using these high speed bi-directional serial communications packet control portions 14-1 to 14-4, switching between update and non-update of windows for the image sources, controlling a pointer, and other controls are performed.

[0117] Examples of multiplexed packet data transfer are IEEE 1394, USB (Universal Serial Bus) or the like. USB is most suitable for this embodiment because presently available desk top type PC's and note type PC's are provided with USB ports and USB supports a hot plug-in connection (allowing plug-in and plug-out during operation). From the viewpoint of the characteristic features of the invention, serial communications of other types are also applicable with similar advantageous effects. Apparatuses for USB include a USB host and USB devices. Generally, the USB host is a personal computer, and the USB devices are peripheral apparatuses such as a mouse, a keyboard and a printer. In this embodiment, the packet control portions 14-1 to 14-4 function as the USB devices.

[0118] The operation of the display system 40 of the third embodiment will be described with reference to Fig. 6.

the main pointer 25. The superposition data memory 10 has a capacity corresponding to the screen size of the display device and has a depth of at least one bit.

[0130] The above operation state is illustrated in Fig. 7B. Since it is assumed in this description that only one image source is connected, only the image of the image source 1-1 is displayed on the screen of the display device. Therefore, in Fig. 7B, the on → off operation of the main button 25 selects the whole image of the image source 1-1.

[0131] The above operations of the control portion 6 are illustrated in the process R0 (r0-1) in Fig. 13 and the process R1 (r1-1 to r1-5) in Fig. 14.

[0132] The control portion 6 instructs the bus controller 5 to enable to control to output or not to output the data in the superposition data memory 10 to the output display format conversion portion 11 in order to display or not to display the main pointer. This control is performed by depressing the button 31 of the remote controller. Similar to the above description, the ON/OFF information of the button 31 is once converted into packeted infrared data and supplied to the control portion (process R0 (r0-4) in Fig. 3 and process R4 in Fig. 17).

[Connection of Two or More Image Sources]

[0133] If two or more image sources are connected, the processes similar to the first embodiment are executed.

[Switching between Input Device Controls of Image Source by Main Pointer]

[0134] Next, a method of switching between input device controls of an image source by the main pointer will be described.

[0135] The remote controller 21 has the subsidiary joy stick 22 and subsidiary button 23 which are input devices of the image source and the main joy stick 24 and main button 25 for controlling the main pointer displayed on the display device and superposed on the input image data.

[0136] The control portion 6 of the display system 40 calculates the four corner coordinate values of the window currently displaying an image, from the numbers of dots and lines to be used for scaling by the display format conversion portions 3-1 to 3-4, and always stores the calculated coordinate values.

[0137] The X and Y coordinate values calculated by the control portion 6 in accordance with the X and Y coordinate motion amount supplied from the main joy stick 24 are used for drawing a pointer figure of a mouse or the like in the superposition data memory 10 at the location corresponding to the X and Y coordinate values to thereafter output the superposition data to the output display format conversion portion 11. In this case, the subsidiary joy stick 22 functioning as one of the input devices of the image source 1-1 by the operations described previously is being connected to the image source 1-1 via the infrared data receiving portion 20, infrared data control portion 19, control portion 6, and packet control portion 14-1, to thereby transfer a packet of a X and Y coordinate motion amount and the like and allow the mouse of the image source 1-1 to move in accordance with the operation of the subsidiary joy stick 23 (Fig. 8A).

[0138] If a user acting upon the remote controller 21 wishes to use the subsidiary joy stick 22 as the input device for controlling the image source 1-2 instead of the image source 1-1, the user moves the main pointer to the area in which the image data 1-2 is displayed by using the main joy stick 24, and then depresses the main button 25. Information of a depression of the button 25 is transferred to the control portion 6 via the infrared data control portion 19. By using the X and Y coordinate information when the button information is received and the already known four corner coordinate values of the image data display window of each image source, the control portion 6 checks through calculation the window having the X and Y coordinate values of the main pointer (process R0 (r0-1) in Fig. 13 and process R1 (r1-1 to r1-4) in Fig. 14).

[0139] If the time while the main button 25 is depressed (button ON) is a predetermined time or shorter and if it is recognized that the current coordinate position is on a window different from a window when the main button 25 was depressed previously, then the control portion 6 switches the packet destination of USB serial communications. Namely, data write into the packet control portion 14-1 in order to supply the image source with the X and Y coordinate motion information of the subsidiary joy stick 22 and the ON/OFF information of the subsidiary button 23, is stopped, and data write into the packet control portion 14-2 starts for the image source 1-2. The color of the frame of the selected window is changed to explicitly shown the currently selected widow, and the color of the frame of the previously selected window is changed to a usual color (process R1 (r1-6, r1-9 to r1-11) in Fig. 14).

[0140] Therefore, the user can control a mouse cursor or the like displayed on the window of the image source 1-2 by using the subsidiary joy stick 22 and subsidiary button 23 as if the subsidiary joy stick 22 and subsidiary button 23 are pointing devices of the image source 1-2.

[0141] In this embodiment, USB is used for serial data communications. In most of serial communications such as USB, communications data such as a command is periodically or non-periodically sent from a host (in the embodiment, image source) to even an input device such as a pointing device which has generally a data flow only from the device to the host. If the input device does not respond to the command, some problem occurs. An example of such a command is a reallocation command of device addresses on the bus. If such a command is not properly responded, the host (image source) sometimes recognizes that the device is in an

ing data and more particularly a partial area of the memory. This memory area is hereinafter called a "clip board". Y1 in Figs. 11A and 11B represents an icon which is written in the superposition data memory by the control portion and is called a "common clip board icon". It is herein assumed that two image sources 1-1 and 1-2 are connected.

[0154] First, a user moves the main pointer to the image of the image source 1-1 by using the joy stick 24 of the remote controller and depresses (button ON) the button 25 to select the image of the image source 1-1. If the time while the button is depressed is a predetermined time (e.g., 1 second) or longer, the control portion 6 controls the bus interface 4-1 to stop the update of the image of the image source 1-1 (process R1 (r1-1 to r1-8) shown in Fig. 14). This operation state is illustrated in Fig. 11A. The control portion 6 therefore enters a "drag state". If the user moves the main pointer to the "common clip board icon" Y1 while depressing the button 25 and releases the depression (button OFF) of the button 25 (Fig. 11B), then the control portion 6 reads the window area corresponding to the image of the image source 1-1 from the frame memory and stores the read data in RAM of the control portion 6. Thereafter, the control portion 6 instructs the bus interface 4-1 to start again the display update (process R1 (r1-2) shown in Fig. 14 and process R5 (r5-1 to r5-3, r5-5 to r5-7) shown in Fig. 18).

[0155] With the above operations, the image of the image source 1-1 is stored in the RAM area of the control portion, i.e., in the "common clip board". Thereafter, the control portion writes data into the superposition data memory so as to change the color or shape of the "common clip board icon" Y1 to explicitly show that the data is being stored in the "common clip board".

[0156] If another user operating the image source 1-2 wishes to copy the data (in this case, image of the image source 1-1) in the common clip board to its own image source 1-1 side, a selection switch "common → local" w3 of the application shown in Fig. 10 is selected and a copy button is depressed so that a command is transmitted to the control portion 6 over USB serial communications to urge the control portion 6 to transmit the data in the common clip board (process A0 (a0-3) shown in Fig. 27 and process A3 (a3-1, a3-3) shown in Fig. 30). Upon reception of this command, the control portion 6 divides the data stored in the internal RAM into data pieces and write them into the packet control portion 14-2 in order to transmit the data over USB serial communications (process P0 (p0-3) shown in Fig. 19, process P2 (p2-4) shown in Fig. 21, and process P6 (p6-1, p6-3) shown in Fig. 25). The application of the image source 1-2 reconfigures the divided data pieces transmitted over USB serial communications, and transfers the reconfigured data to a "local clip board" under management of the GUI environment running on the image source (process A3 (a3-4) shown in Fig. 30). The memory area for temporarily saving data such as "clip board" of this embodiment is generally defined in the GUI environment. The "local clip board" means such a memory area. The area in which data is actually stored may be a memory IC or a memory disk medium such as a hard disk and a DVD.

[0157] With the above operations, it is possible to transfer the image data displayed on the display system to another image source, by using the saving function of the "common clip board".

[PC → PC]

[0158] It is possible for the image sources to share image data by using the "common clip board".

[0159] For example, a user operating the image source 1-1 transfers data to be shared to the local clip board under management of the GUI environment, and thereafter selects the selection switch w3 "local → common" of the application shown in Fig. 10 and depresses the copy button. In this case, the application L1 first sends a command to the control portion 6 over USB serial communications to notify that the data is transferred. The application then reads the data from the local clip board under management of the GUI environment, converts the data into a packet and transfers the packet to the control portion 6 over USB serial communications (process A0 (a0-3) shown in Fig. 27 and process A3 (a3-2, a3-5, a3-6) shown in Fig. 30).

[0160] In response to the command, the control portion 6 receives the data via the packet control portion 14-1, saves the data in the internal RAM, and changes the color or shape of the "common clip board icon" of the superposition data memory 10 to explicitly show that the data is being saved in the "common clip board" (process P0 (p0-3) shown in Fig. 19, process P2 (p2-4) shown in Fig. 21, and process P6 (p6-2, p6-4) shown in Fig. 25.

[0161] If another user operating the image source 1-2 wishes to copy the data saved in the "common clip board" to the image source 1-2 side, the user selects the selection button w3 "common → local" of the application shown in Fig. 10 and depresses the copy button so that a command is transmitted to the control portion 6 over USB serial communications (process A0 (a0-3) shown in Fig. 27 and process A3 (a3-1, a3-3) shown in Fig. 30).

[0162] After the control portion 6 receives this command, it divides the data stored in the internal RAM into data pieces and writes them into the packet control portion 14-2 in order to transmit the data over USB serial communications (process P0 (p0-3) shown in Fig. 19, process P2 (p2-4) shown in Fig. 21, and process P6 (p6-1, p6-3) shown in Fig. 25). The application of the image source 1-2 reconfigures the divided data pieces transmitted over USB serial communications, and transfers the reconfigured data to the "local clip board" under management of the GUI environment (process A3 (a3-4) shown in Fig. 30). With the above operations, it is possible to transfer the image data from the image source 1-1 to the image source 1-2 by using the saving

[0172] As described earlier, although USB is used as a means for the communications between the display system and image source in the above embodiments, the invention is not limited only thereto, but it is obvious that other communications means may also be used from the viewpoint of the characteristic features of the invention. Further, the embodiments use an image source running on the relatively highly sophisticated GUI environment such as Windows including a mouse cursor, a window layout, a cubic button and a text box. However, from the viewpoint of the characteristic features of the invention, the invention is not limited only thereto, but any other GUI environments may be applied if a user can operate the image source by selecting an item displayed on the display screen, such as a GUI environment which provides a simple text operation screen and a simple cursor display.

[0173] As described so far, according to the display system of the embodiment, a display position of the second position indication mark to be displayed by the second overlay display means is determined in accordance with the user information supplied via the communications means from the user information input means, relative to one piece of the image information selected by the first position indication mark displayed by the first overlay display means, and an operation of the second overlay display means is controlled in accordance with the determined display position. Accordingly, the display of images to be displayed on a conference/presentation display device can be controlled easily by using at least one image display apparatus.

[0174] According to a display system of the embodiment, an operation of the image input means is inhibited in accordance with the user information supplied via the communications means from the user information input means. Accordingly, the display update/non-update of the image information output from each image display apparatus and displayed on the display device can be controlled by using the user information input means of the image display apparatus, and the display of images to be displayed on a conference/presentation display device can be controlled easily by using at least one image display apparatus.

[0175] According to the display system of the embodiment, one piece of image information selected by the first position indication mark displayed by the first overlay display means is read from the memory means, and the read one piece of image information is transmitted to at least one image display apparatus via the communications means. Accordingly, one piece of image information selected by the first position indication mark can be read from the memory means storing images to be displayed on the display devices and can be acquired by at least one image display apparatus, and the display of images to be displayed on a conference/presentation display device can be controlled easily by using at least one image display apparatus.

[0176] According to the display system of the embodiment, one piece of image information selected by the first position indication mark displayed by the first overlay display means is read from the first memory means and temporarily stored in the second memory means, and the temporarily stored one piece of image information is transmitted to at least one image display apparatus via the communications means. Accordingly, it is possible to easily transfer image information between image display apparatuses, and the display of images to be displayed on a conference/presentation display device can be controlled easily by using at least one image display apparatus.

[0177] According to the display system of the embodiment, a display position of the second position indication mark to be displayed by the second overlay display means is input by the display position information input means of the display control apparatus, relative to one piece of the image information selected by the first position indication mark displayed by the first overlay display means, and an operation of the second overlay display means is controlled in accordance with the input display position. It is therefore possible to control the display position of the second position indication mark on the display device corresponding to each image display apparatus, and the display of images to be displayed on a conference/presentation display device can be controlled easily by using at least one image display apparatus.

[0178] A display system for receiving image data from a plurality of image sources and displaying the received image data on a display unit. The display system includes: an input unit for inputting a control signal supplied from an input/output unit, a controller for controlling an image to be displayed on the display unit in accordance with the control signal input from the input unit; an image selection unit for selecting a desired image from images displayed on the display unit; and a switching unit for switching an image to be controlled by the controller in accordance with the image selected by the image selection unit.

Claims

1. A display control apparatus having user information input means and connected via communications means to at least one image display apparatus for outputting image information, the display control apparatus comprising:

   image input means for receiving at least one piece of image information output from said at least one image display apparatus;
   a display device for displaying said at least one piece of received image information;
   first overlay display means for displaying in an overlay manner a first position indication mark on said display device in order to select one

image display apparatus among said at least one image display apparatus which does not output the image information.

11. A display control apparatus according to claim 9, wherein said at least one image apparatus has memory means for storing the transmitted one piece of image information.

12. A display control apparatus according to claim 9 or 11, further comprising inhibition means for inhibiting an operation of said image input means when said transmitting means reads the selected one piece of image information from said memory means.

13. A display control apparatus according to claim 9, wherein said communications means is bi-directional serial communications means.

14. A display control apparatus according to claim 9 or 13, wherein said first overlay display means includes display position information input means for inputting display position information of the first position indication mark to be displayed on said display device.

15. A display system comprising the display control apparatus according to claim 9 and at least one image display apparatus connected via the communication means to the display control apparatus and having user information input means for outputting image information.

16. A display control apparatus having user information input means and connected via communications means to at least one image display apparatus for outputting image information, the display control apparatus comprising:

image input means for receiving at least one piece of image information output from said at least one image display apparatus;
first memory means for storing said at least one piece of received image information;
second memory means for temporarily storing the image information;
display device for displaying said at least one piece of received image information stored in said first memory means;
first overlay display means for displaying in an overlay manner a first position indication mark on said display device in order to select one piece of image information from said at least one piece of image information displayed on said display device;
second overlay display means for displaying in an overlay manner a second position indication mark on said display device; and
transmitting means for reading the one piece of image information selected by the first position indication mark displayed by said first overlay display means from said first memory means, temporarily storing the read one piece of image information in said second memory means, and transmitting the temporarily stored one piece of image information to said at least one image display apparatus via said communications means.

17. A display control apparatus according to claim 16, wherein said at least one image display apparatus to which the read one piece of image information is transmitted by said transmitting means includes an image display apparatus among said at least one image display apparatus which does not output the image information.

18. A display control apparatus according to claim 16 wherein said at least one image apparatus has memory means for storing the transmitted one piece of image information.

19. A display control apparatus according to claim 16 or 18, further comprising inhibition means for inhibiting an operation of said image input means when said transmitting means reads the selected one piece of image information from said first memory means.

20. A display control apparatus according to claim 16, wherein said communications means is bi-directional serial communications means.

21. A display control apparatus according to claim 16 or 18, wherein said first overlay display means includes display position information input means for inputting display position information of the first position indication mark to be displayed on said display device.

22. A display system comprising the display control apparatus according to claim 16 and at least one image display apparatus connected via the communication means to the display control apparatus and having user information input means for outputting image information.

23. A display control apparatus having user information input means and connected via communications means to at least one image display apparatus for outputting image information, the display control apparatus comprising:

image input means for receiving at least one piece of image information output from said at least one image display apparatus;

plurality of image sources and displaying the received image data on a display unit; the display system comprising:

scale varying means for varying a display scale of each image to be displayed on the display unit;
a memory structured hierarchically for storing each image to be displayed on the display unit at each hierarchical level assigned a priority order; and
display style setting means for setting a display style of each image to be displayed on the display unit, in accordance with a scaling factor of the image set by said scale varying means and the priority order of the image stored in said memory.

37. A display system according to claim 36, further comprising reception means for receiving a control program from an external apparatus and control means for controlling the display style of each image to be displayed on the display unit in accordance with the control program received by said reception means, in place of said display style setting means.

FIG. 2

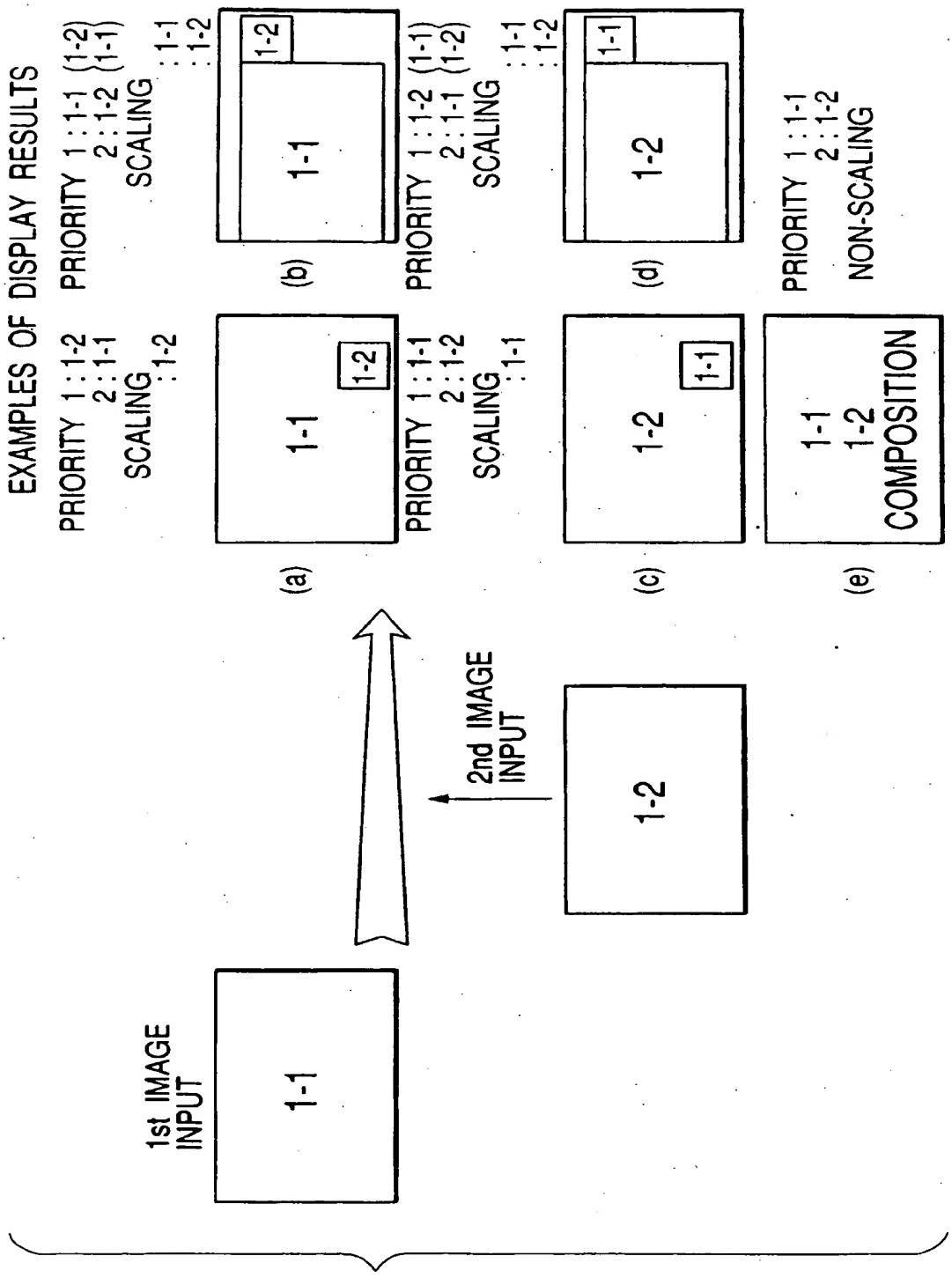


FIG. 4A

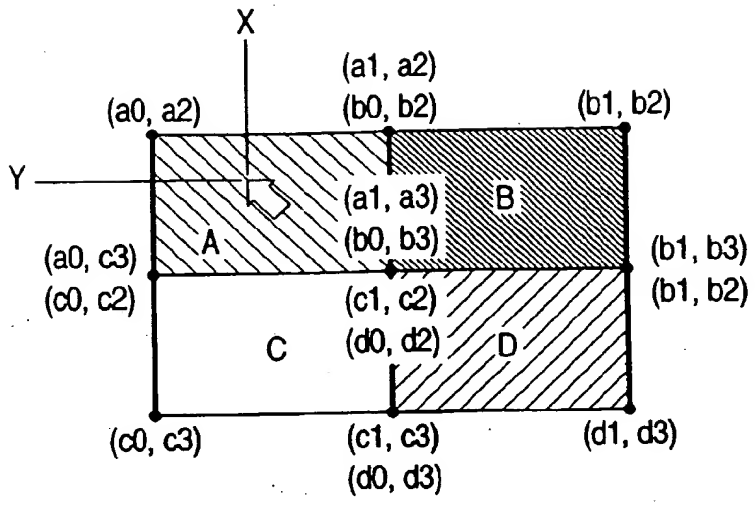


FIG. 4B

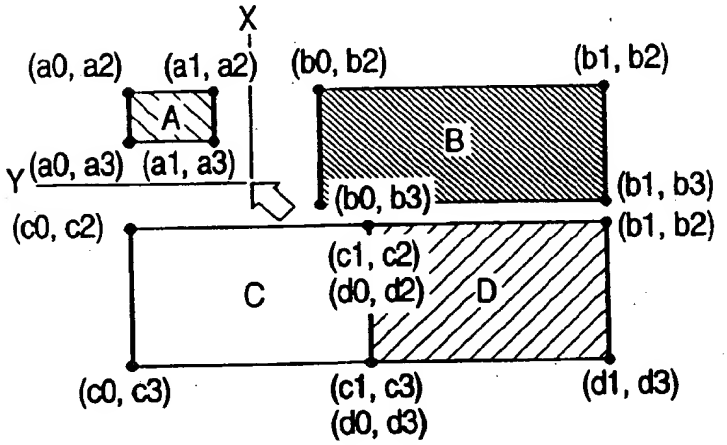


FIG. 4C

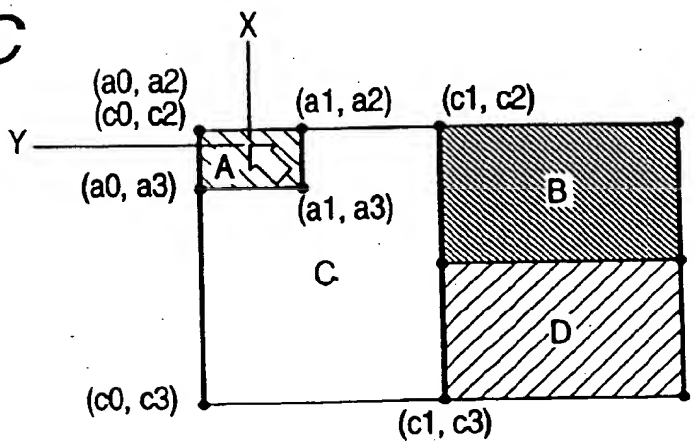


FIG. 6

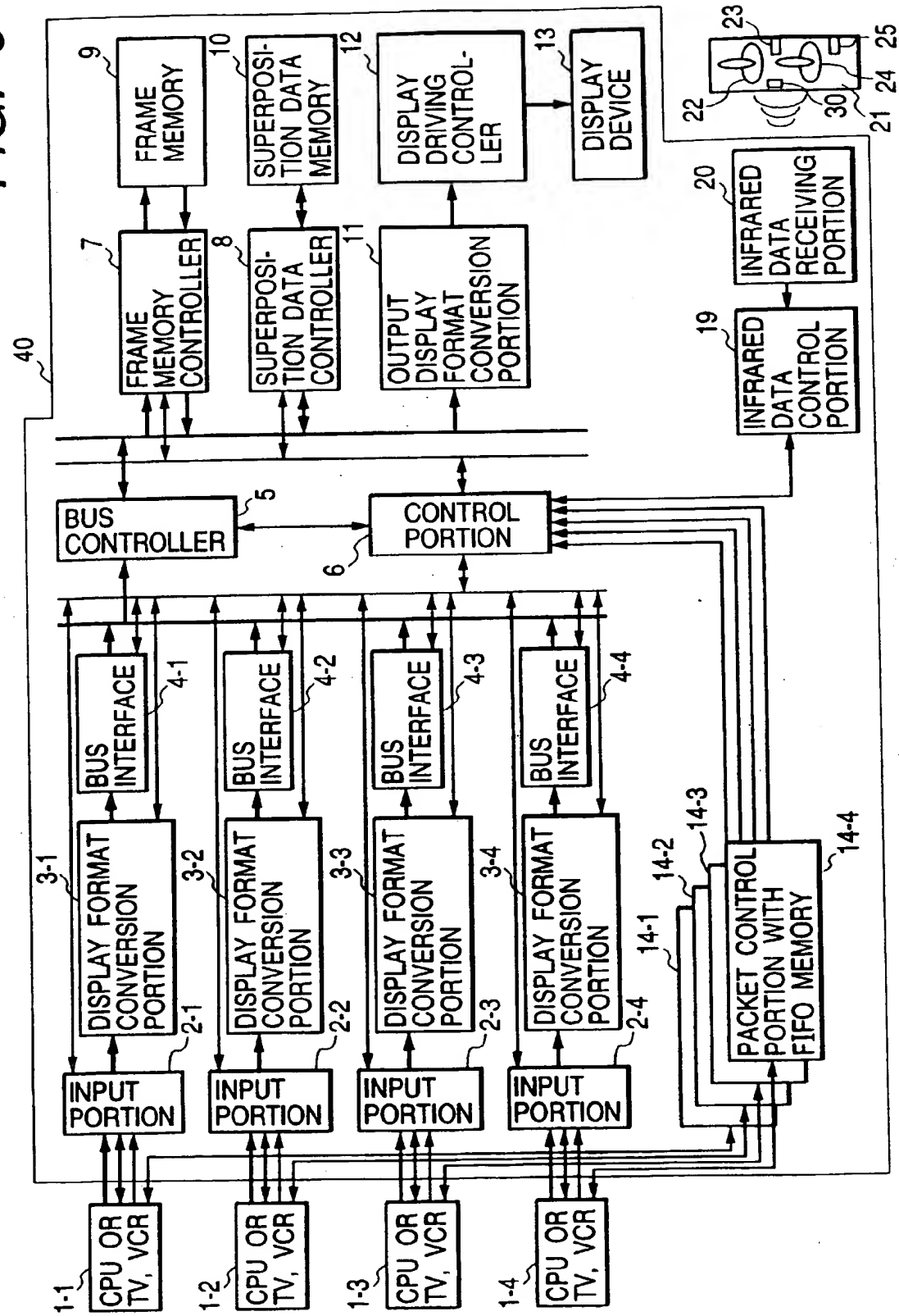


FIG. 9

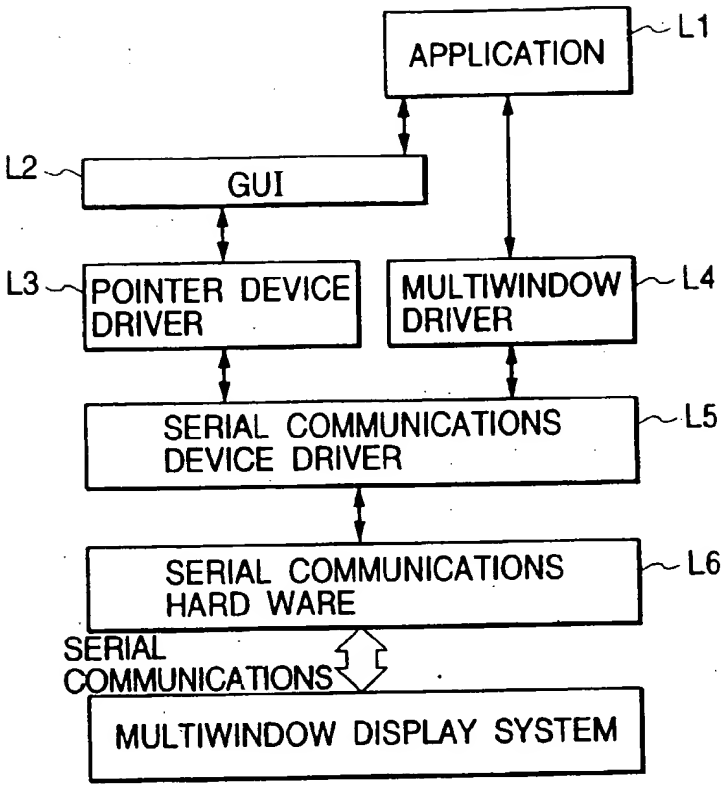


FIG. 10

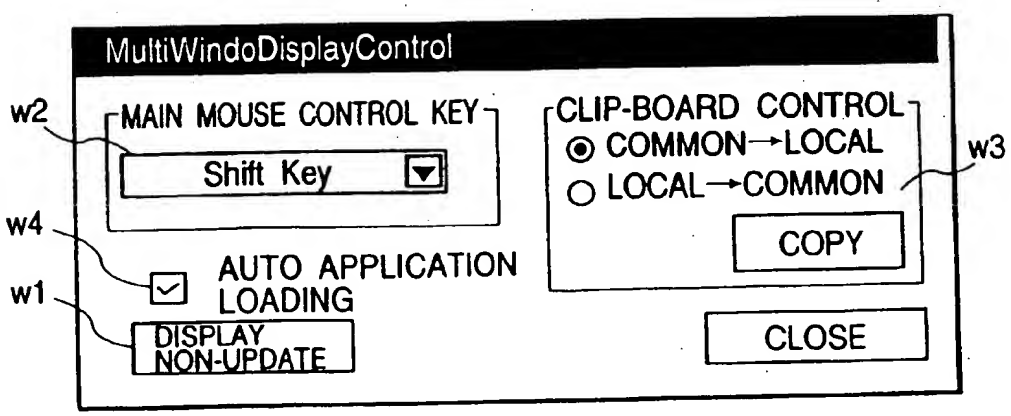


FIG. 13

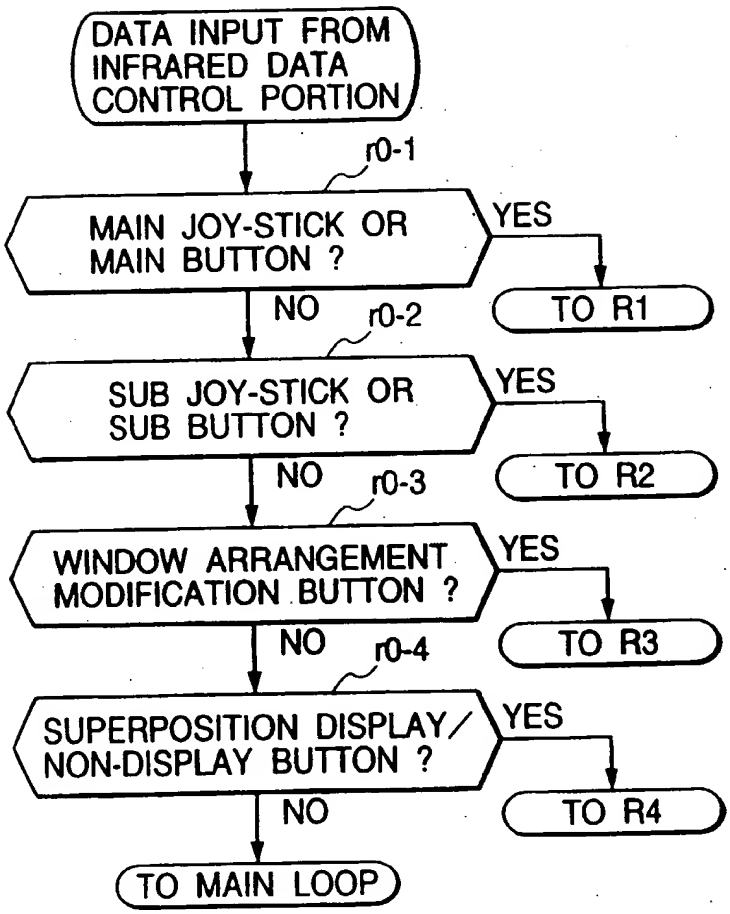


FIG. 15

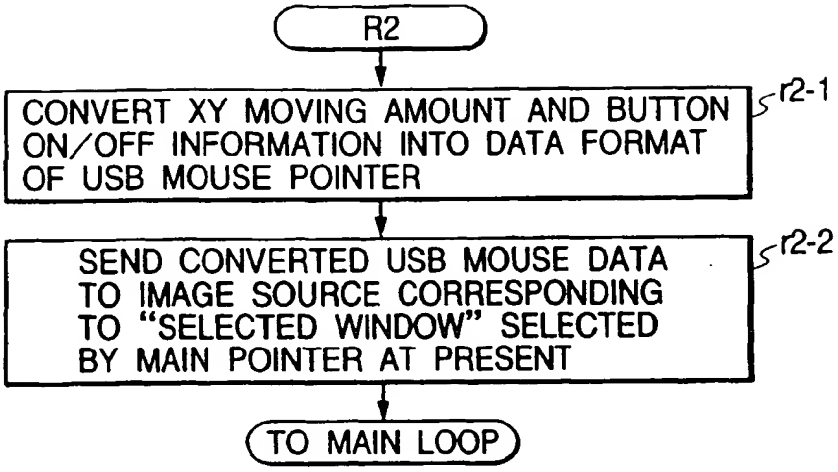


FIG. 16

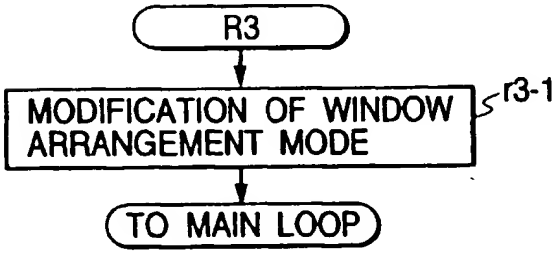


FIG. 17

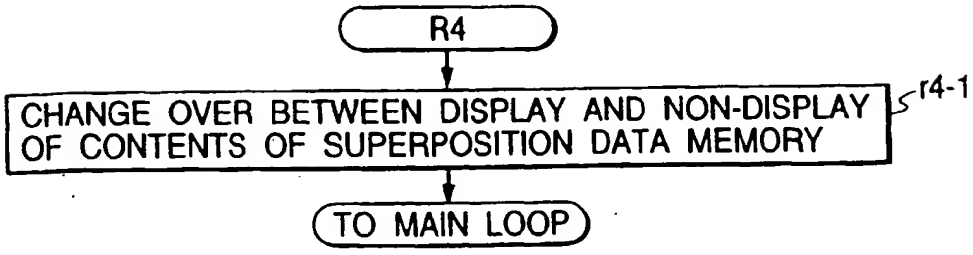


FIG. 19

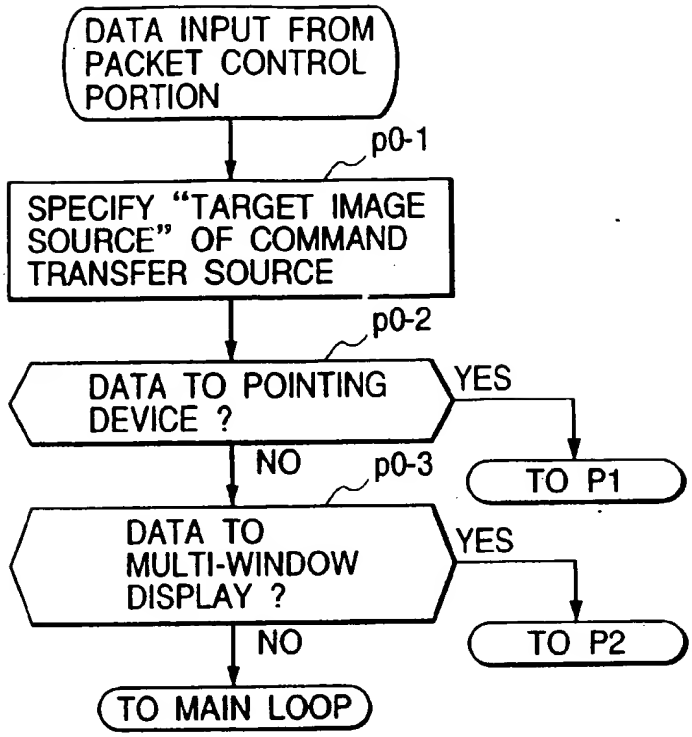


FIG. 20

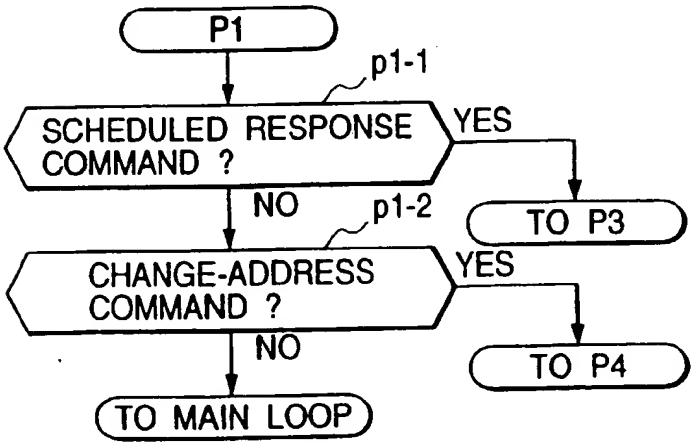


FIG. 22

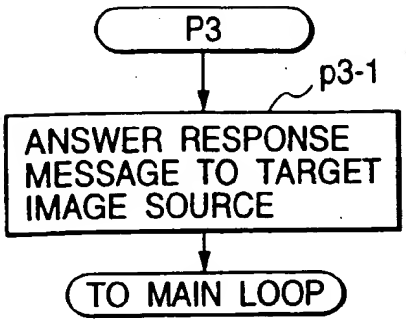


FIG. 23

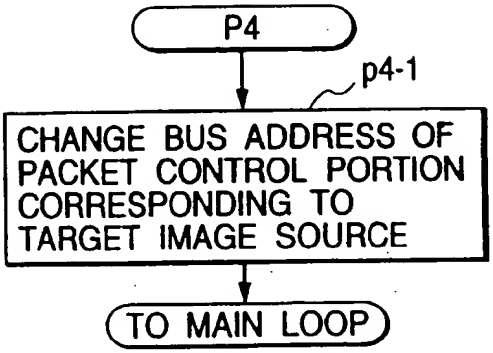


FIG. 24

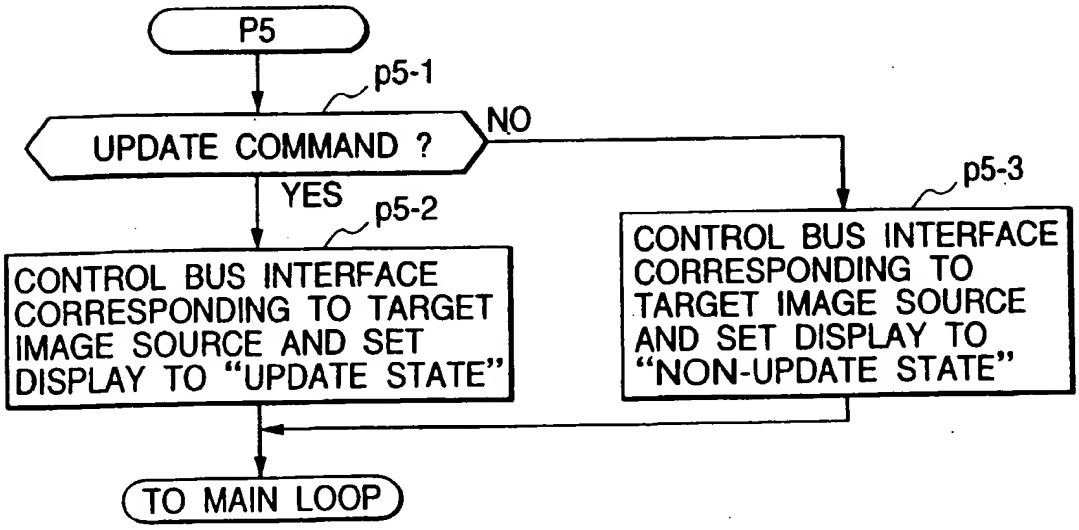


FIG. 27

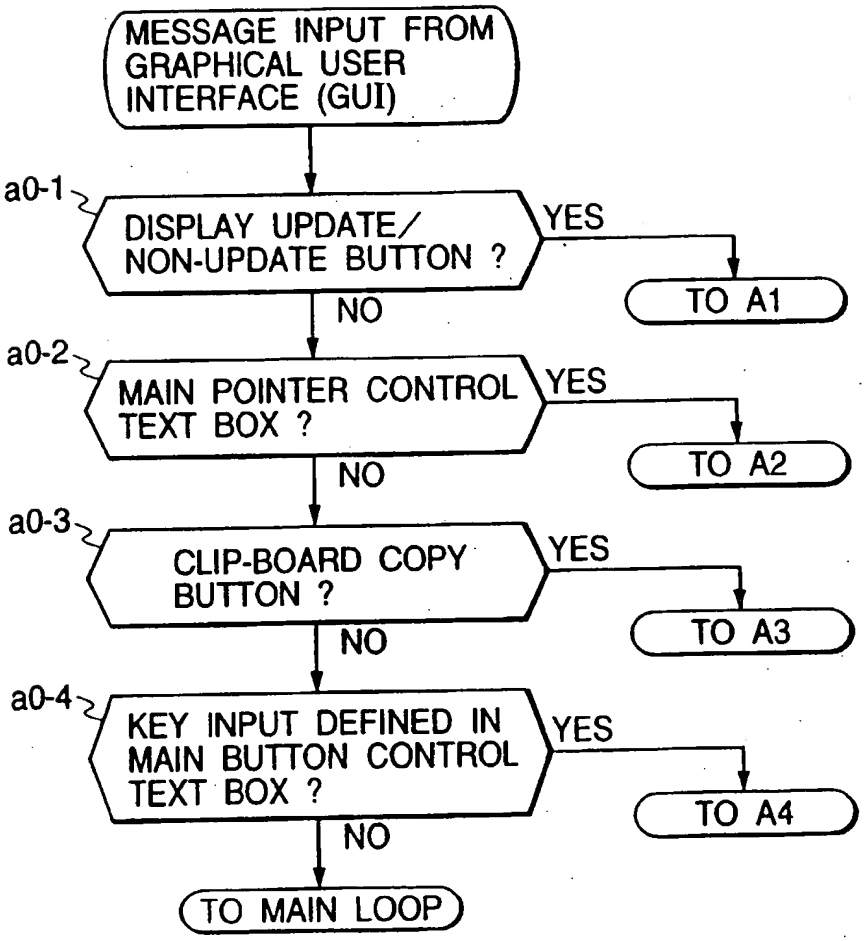
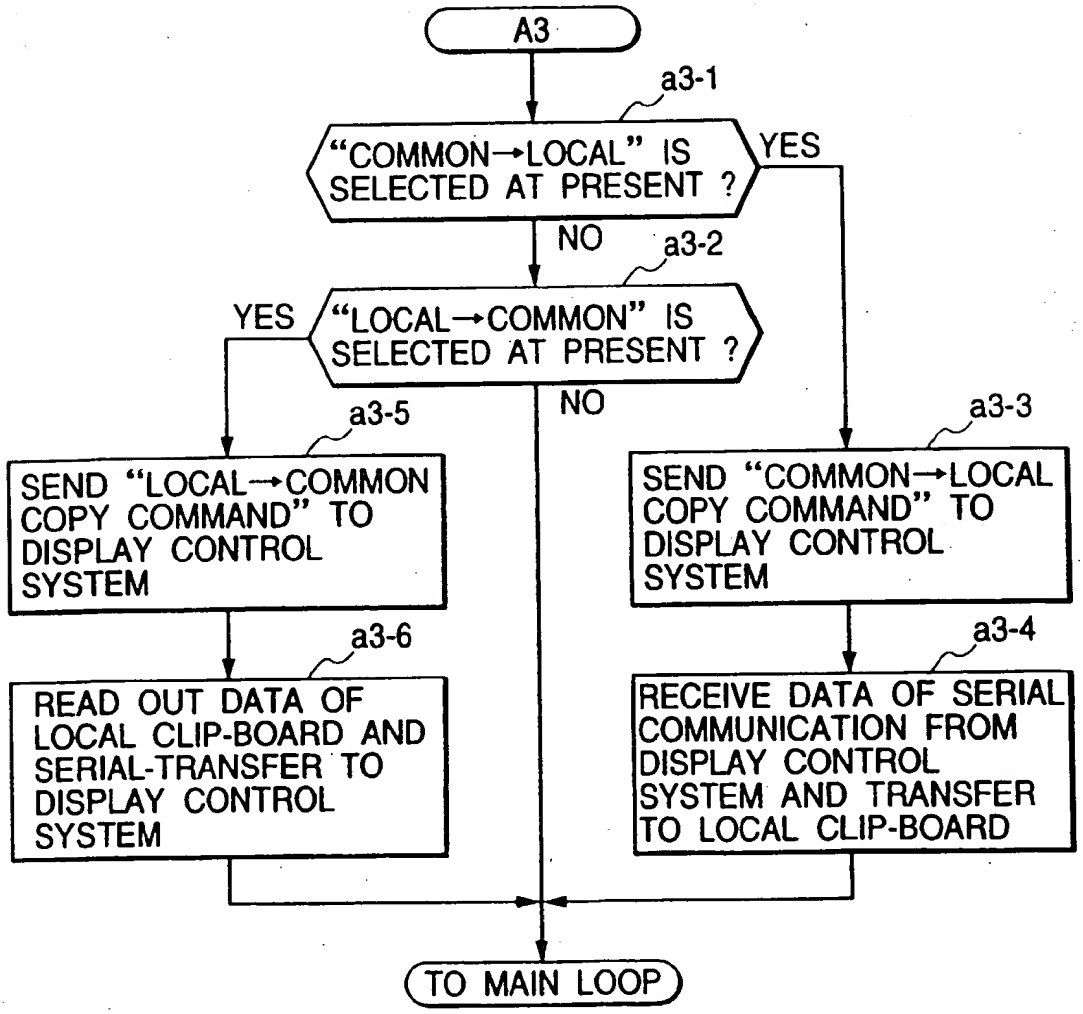


FIG. 30



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(54) Display control apparatus and display system

(57) A display system for receiving image data from a plurality of image sources and displaying the received image data on a display unit. The display system includes: an input unit for inputting a control signal supplied from an input/output unit, a controller for controlling an image to be displayed on the display unit in accordance with the control signal input from the input unit; an image selection unit for selecting a desired image from images displayed on the display unit; and a switching unit for switching an image to be controlled by the controller in accordance with the image selected by the image selection unit.

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 10 7656

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